A water quality model was developed to simulate the eutrophication processes in the Golden Gate Canal System, Collier County, Florida. The model was built in MIKE 11/ECOlab software by DHI. The MIKE11 module was used to solve the hydrodynamic equations for the open system, and the MIKE SHE module was used to solve the hydrodynamic equations for the canals. ECOlab is a template that allows simulations of the water quality processes. For the MIKE11 simulations, the equations and parameters in the ECOlab template were modified consistent with the USEPA Water Quality Analysis Simulation Program (WASP). The runoff and baseflow volumetric rates in the canals were extracted from a regional MIKE11-MIKE SHE model for Collier County from which the MIKE11 model for the Golden Gate area was telecopied. The simulation period was chosen as one year (i.e., from June, 2003 to June, 2004), where the annual precipitation rate is close to the historical average. The model results were compared to the observed water quality data measured during the year (also measured in other years) in order to adjust the eutrophication related model parameters. The calibrated model was used to display the spatial and temporal variability of the water quality constituents. Two sensitivity tests were conducted by varying the parameters of the model in order to adjust the eutrophication processes. This may be a consequence of assuming constant values of the constituents. The processes and sources in the AD equations are considered as lumped point sources. A removal efficiency was assumed in urban landuses. As a result, the DO concentration during rainy months decreased 0.33 mg/l in average in canals at observation stations, which represents only 7% of the decrease of 4.45 mg/l in runoff DO concentration. The runoff DO concentration change is included when entering in the canal is 45% because of the presence of baseflow and 47% because of the DO processes. This small change average of 0.33 mg/l is in agreement with DO increase in some branches during the rainy months (see maps below), which is typically not higher than one step in the color scale with 1 mg/l interval. Therefore, the results in this sensitivity test do not support the hypothesis that there are other causes than the DO concentrations in the canals might be caused by the anthropogenic increase in BOD and nutrients loading. As a result, the DO concentration during rainy months decreased 0.33 mg/l in average in canals at observation stations, which represents only 7% of the decrease of 4.45 mg/l in runoff DO concentration. The runoff DO concentration change is included when entering in the canal is 45% because of the presence of baseflow and 47% because of the DO processes. This small change average of 0.33 mg/l is in agreement with DO increase in some branches during the rainy months (see maps below), which is typically not higher than one step in the color scale with 1 mg/l interval. Therefore, the results in this sensitivity test do not support the hypothesis that there are other causes than the DO concentrations in the canals might be caused by the anthropogenic increase in BOD and nutrients loading.

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Results - plots

The first series of plots displayed in simulated concentrations after the calibration are presented below at the downstream end of the Golden Gate Waterway. Black lines are model results, red lines measurements during the simulation period, and blue circles measurements in other years. In general, the plots at observation stations show good agreement between the model results and the observation data. The scatter plots including all observed vs. simulated concentrations for BOD and nutrients (NH4, NO3, ORP) are shown through the color of the points. In general, the DO concentration during rainy months decreased 0.33 mg/l in average in canals at observation stations, which represents only 7% of the decrease of 4.45 mg/l in runoff DO concentration. The runoff DO concentration change is included when entering in the canal is 45% because of the presence of baseflow and 47% because of the DO processes. This small change average of 0.33 mg/l is in agreement with DO increase in some branches during the rainy months (see maps below), which is typically not higher than one step in the color scale with 1 mg/l interval. Therefore, the results in this sensitivity test do not support the hypothesis that there are other causes than the DO concentrations in the canals might be caused by the anthropogenic increase in BOD and nutrients loading. As a result, the DO concentration during rainy months decreased 0.33 mg/l in average in canals at observation stations, which represents only 7% of the decrease of 4.45 mg/l in runoff DO concentration. The runoff DO concentration change is included when entering in the canal is 45% because of the presence of baseflow and 47% because of the DO processes. This small change average of 0.33 mg/l is in agreement with DO increase in some branches during the rainy months (see maps below), which is typically not higher than one step in the color scale with 1 mg/l interval. Therefore, the results in this sensitivity test do not support the hypothesis that there are other causes than the DO concentrations in the canals might be caused by the anthropogenic increase in BOD and nutrients loading.

The second sensitivity test (ST2) was conducted to evaluate the influence of the anthropogenic increase in BOD and nutrients loading. As a result, the DO concentration during rainy months decreased 0.33 mg/l in average in canals at observation stations, which represents only 7% of the decrease of 4.45 mg/l in runoff DO concentration. The runoff DO concentration change is included when entering in the canal is 45% because of the presence of baseflow and 47% because of the DO processes. This small change average of 0.33 mg/l is in agreement with DO increase in some branches during the rainy months (see maps below), which is typically not higher than one step in the color scale with 1 mg/l interval. Therefore, the results in this sensitivity test do not support the hypothesis that there are other causes than the DO concentrations in the canals might be caused by the anthropogenic increase in BOD and nutrients loading.
Satinleaf tree island, Shark River